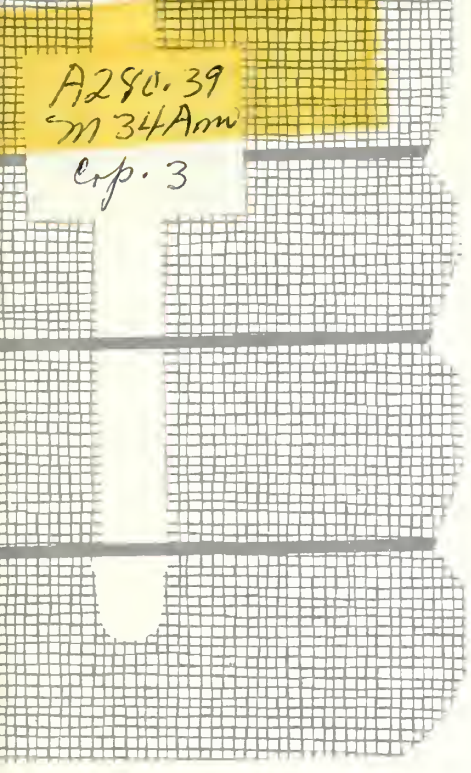
Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

A280.39
M34Amw
cop. 3

AMS-361

FEB 15 1960
U. S. DEPARTMENT OF AGRICULTURE



mixed-quality COTTON BALES

U.S. DEPARTMENT OF AGRICULTURE

Agricultural Marketing Service

Marketing Economics Research Division

CONTENTS

	Page
Summary	4
Background of the problem	7
Scope and method of study	9
Rules and regulations relating to mixed-quality bales	10
Extent of mixed-quality bales	11
Geographic distribution	11
Seasonal distribution	14
Nature of mixed-quality bales	15
Types of mixed-quality bales by State origins	15
Effect of time of ginning on type of quality mixture	18
Monetary significance of mixtures of quality within bales	18
Practices of shippers in merchandising mixed-quality bales	20
Probable causes of mixed-quality bales	23
Variations in fiber characteristics among the two sides of cotton bale samples	27
Appendix	30

ACKNOWLEDGMENT

Special credit is due Mrs. Eleanore Seaborn for planning and conducting the assembly and tabulation of the large volume of basic information. The collection of primary data was made possible by the efforts of the entire field organization of the Cotton Division of the Agricultural Marketing Service, U. S. Department of Agriculture, and by the cooperation of numerous cotton shippers and ginners.

Washington, D. C. February 1960

SUMMARY

Variations in quality of cotton within bales--whether in grade, staple, or other fiber properties--often result in sharp reduction in returns to growers and create problems in properly evaluating and utilizing such bales. The study of these problems on which this marketing research report is based was initiated in 1954 to determine the frequency of occurrence of bales of mixed grade and staple. This work was followed in 1955-56 by research designed to isolate some of the major factors contributing to the occurrence of bales of mixed grade and staple, and finally, in 1957-58 by research designed to indicate variations in other fiber properties.

An estimated 3.4 percent of the cotton produced in the 1954-55 season consisted of mixed-quality bales. For the purposes of this study, such bales were defined as those of which the two parts of the bale sample differed by one grade or more, one or more colors, or 1/16 inch or more in staple. Mixed-quality bales are assigned the quality indicated by the low side of the sample. Such bales cause growers to sell an undetermined amount of better cotton at a price set by an equally unknown portion of poorer cotton, and also create risks in marketing. Discussions with marketing agencies indicated that the level of mixed-quality bales in the season of study was highly similar to that encountered in the several preceding seasons.

Proportions of mixed-quality bales were above the national average in only three States--Arkansas, Oklahoma, and Texas. Together, these States accounted for about 37 percent of the crop and approximately 70 percent of the mixed-quality bales. In all other States, only from 1 to 2 percent of ginnings were of mixed quality.

Mixed-quality bales tended to become more prevalent as the ginning season progressed. For the Cotton Belt as a whole, proportions of ginnings that were mixed in quality increased from 2.7 percent in September to a high of 5.7 percent for cotton ginned after January 16.

Although 50 different types of quality variations were found, in the great majority of cases only one quality element was involved. About 64 percent of the mixed-quality bales varied only in grade, 7.5 percent in staple only, and 5.6 percent in color only. Of the approximately 23 percent remainder that was mixed in two or more quality elements, about three out of four bales were mixed in both grade and color.

About 70 percent of mixed-quality bales resulted from quality variations of a minimum degree--one grade, 1/16 inch of staple length, or one color. At the other end of the scale, 2.6 percent of the mixed-quality bales were so severely mixed that they were classed as mixed packed.

On the basis of the average grade and staple differences for the 14 designated spot markets for the season, the average price difference between the qualities of cotton found in mixed-quality bales was 210 points. Assuming a

50-50 distribution of the better and poorer cotton, the net loss to growers was 105 points or $5.25 per bale. If all such bales in 1954-55 had been marketed as bales of uniform quality, the income of farmers involved would have been increased by about $2,400,000.

Selected shippers in the Memphis, Dallas, and Houston markets reported that their estimated purchases of mixed-quality bales in major areas of production in Arkansas, Oklahoma, and Texas were in about the same proportions as indicated by the study. They also indicated that these areas were the major trouble spots for such cotton.

Of the 57 cotton shipping firms interviewed, 18 firms reconditioned no mixed-quality bales during the season. The other 39 firms together had acquired 97,189 bales of mixed-quality cotton from the designated trouble areas. Of these mixed-quality bales, about 13 percent were examined for possible correction of the quality irregularity, a process which usually required removal of ties from the bales. Of the total bales examined, about 41 percent were reconditioned. The average estimated cost per bale reconditioned, counting the cost of working both bales actually reconditioned and those re-pressed without being reconditioned, was $8.82. This high cost explains why most mixed-quality bales move through marketing channels without being corrected.

Most shipping firms did not consider mixed-quality bales a serious problem in buying cotton. Shippers also stated that claims seldom were received from mills on such bales. In general, these bales were accepted as an unavoidable annoyance and minor risk inherent in the business.

A common belief has been that mixed-quality bales originate at gins because the press box is turned prematurely, so that many bales include small amounts of cotton on one surface that should have been in the preceding bales. A less prevalent supposition has been that many mixed-quality bales occur because growers bring mixed loads of seed cotton to gins.

During the 1955-56 season, bale-by-bale records were kept on about 34,000 bales, representing the total volume of 10 gins with a former record of high incidence of mixed-quality bales. Indications were that cotton for 61 percent of mixed-quality bales was brought to the gin as mixed seed cotton, and 22 percent of the bales apparently were mixed at the gin by addition of higher quality cotton and 17 percent by the addition of lower quality cotton. Some factors accounting for mixed loading of seed cotton at farms are beyond the control of growers. On the other hand, growers can and should avoid loading cotton together that differs in variety or time and method of harvest. A coordinated educational program directed at both growers and ginners apparently would lead to a reduction in the number of such bales.

Laboratory instruments and tests for measuring some of the fiber characteristics of cotton now are being used extensively in the marketing of cotton, especially for fineness and, to a lesser extent, for tensile strength. Although marketing agencies examine both sides of bale samples in determining grade and staple, generally only one side of the same samples is used in making fiber

tests. If a bale is mixed in grade or staple, the handler is alerted that fiber characteristics may also vary and in such cases both sides often are tested. A matter of concern, however, has been the extent to which fiber test data may vary for the two sides of samples which do not differ in grade and staple.

For study purposes, tests of both sides of a large volume of bale samples which were uniform in grade and staple were made for fineness, strength, and upper half mean (Fibrograph). Two-thirds of the samples tested showed no significant variation between the two sides in any of the three fiber properties. Where significant variations did exist, strength accounted for more than half of the variability. About 10 percent of samples showed significant differences in fineness (0.3 readings or greater) for the Belt as a whole. For cotton originating from the South Central region, only 1 of every 25 bales had a significant lack of uniformity in fineness results. For Southwestern cotton, one of each seven bales differed significantly between the two sides of samples in fineness readings.

MIXED-QUALITY COTTON BALES

By R. C. Soxman, agricultural economist,
Marketing Economics Research Division
Agricultural Marketing Service

BACKGROUND OF THE PROBLEM

A cotton bale is sampled commercially for classification by cutting out two small portions of cotton, one from each side. The classer therefore examines a two-part sample which includes a bit of the first cotton entering the bale and a few ounces of the last cotton. The classer then describes cotton quality in terms of grade and staple according to the official standards of the United States.

When the two sides of a sample are alike in grade and staple, it is assumed that the cotton is uniform throughout the bale. If, however, the two parts of the sample differ in grade or staple, the bale is assigned the quality indicated by the low side of the sample. Such mixed-quality bales commonly are called "two-sided" or "plated" bales.

The quality of cotton also depends upon fiber properties such as fineness, tensile strength, length uniformity, and maturity. These properties are referred to as "character," and there are no standards for character. Although classers can get impressions of character factors, they cannot provide accurate measurements. The terms mixed-quality, plated, or two-sided bale, through popular usage, have been applied to bales in which the class indicated a mixture in grade or staple. Cotton on the two surfaces of a bale may vary also in other fiber properties.

In marketing channels, during recent years, widespread use has been made of laboratory instruments for measuring fiber characteristics of raw cotton such as fineness, strength, length, and length uniformity. When bales are found to be mixed in grade or staple, handlers are alerted that significant differences may be present in other fiber characteristics as well. Differences do occur also in test results between the two sides of samples that are alike in grade and staple. Information on the extent and frequency of variations in fiber properties in samples relatively uniform in grade and staple would provide guides to merchandising agencies.

Bales mixed in grade or staple are believed by many to occur either because growers bring a mixed load of cotton to the gin or because the ginner mixes cotton from different loads. Obviously the mixing is not intentional, but these bales do appear in marketing channels in some areas with monotonous regularity.

Although the extent of quality variations is small for many mixed bales, the problem has several undesirable results. Very important is the financial loss suffered by growers in selling some undetermined amount of better cotton at a price set by an equally unknown amount of poorer cotton. Also, the sample drawn from a badly mixed bale offers great temptation for fraudulent practice, since the bad half of the sample can be thrown away and two portions of the better half can be used, increasing the apparent value of the bale appreciably. In addition, a mixed-quality bale generally requires removal of bands and later rebaling to permit accurate appraisal of contents. This is feasible only at the compress, usually after cotton has passed from the hands of growers. It is an expensive operation and, even after examination of an opened bale, reconditioning often is not practicable. In marketing channels, shippers not uncommonly encounter annoying inconsistencies in resampling and reclassing this type of bale.

Overseas, American cotton must compete with foreign growths, several of which are packaged so as to provide an even running quality of cotton within each bale. Furthermore, mixed-quality bales provide a poor contrast to the uniformity of manmade staple fibers.

Studies of the problem have been few. During the 1932-33 season, estimates from cotton buyers operating in 10 States indicated that 12.7 percent of the cotton handled consisted of two-sided bales. 1/ In the 1949-50 season, classers employed by the U. S. Department of Agriculture estimated that 13.4 percent of the cotton classed that season was of mixed quality. 2/ Both sets of estimates were based on a very exacting definition of staple in a mixed-quality bale, since bales with a difference of 1/32 inch between the two sides of the sample were considered as mixed in quality. Although these studies indicated in a general way that mixed-quality bales were more common in some areas than others, information then available was not sufficient for serious evaluation of the problem.

So far as is known, no study has been made of bales which are mixed only in terms of fiber test data. The routine use of laboratory tests in evaluating cotton quality is so recent that little attention has been given to either the extent or causes of such admixtures. In marketing use, the term two-sided, or plated, has been applied almost exclusively to bales that are mixed in grade or staple, and no specific descriptive term has evolved for bales mixed in other fiber characteristics only.

As participation by cotton growers in the Smith-Doxey cotton classing program became increasingly greater, the large volume of samples arriving regularly at Government classing offices began to offer a sound basis for study of bales that were mixed in grade or staple. During the 1953-54 season,

1/ Martin, S. W., and Cleaves, F. Sampling American Cotton, U. S. Dept. Agr. Aug. 1936 (processed).

2/ Soxman, R. C., and Gaus, G. E. The Sampling of Cotton Bales as Related to Marketing. U. S. Dept. Agr., Nov. 1950 (processed).

about 78 percent of the crop was classed for growers by the U. S. Department of Agriculture on Form 1 Memoranda, popularly called the Smith-Doxey or "green card" class. A check at the close of this season indicated that this large volume of samples provided excellent geographical coverage except in a few sections of moderate to small production. Also, the Department annually was collecting cotton samples on a Cotton-Belt-wide basis representing principal varieties in commercial production. Such samples were being tested for fiber characteristics for reporting purposes.

Scope and Method of Study

This study was designed (1) to obtain information on the nature and extent of bales mixed in grade or staple, by origin and time of ginning; (2) to develop data suitable for appraising means of reducing the relative volume of such bales; and (3) to evaluate the frequency and extent to which bales that are uniform in grade and staple may vary in fiber characteristics according to routine test procedures.

Information on bales mixed in grade or staple was obtained during the 1954-55 and 1955-56 seasons. Data relating to bales that were mixed in terms of fiber characteristics were secured from cotton ginned during the 1957-58 season. Intact lots of Smith-Doxey samples were selected at random daily throughout the 1954-55 ginning season at each of the 28 classing offices of the Department, at a predetermined rate estimated to equal 2.5 percent of the total production of cotton in the territory served by each office. For each lot chosen randomly for observation, a record was made of the origin, date, number of bales, and class of both sides of any samples which were of mixed-quality.

For the purposes of this study, mixed-quality samples were defined as those in which the two parts differed by:

a. One full grade step or more within a color group;
b. One or more colors;
c. 1/16 inch or more in staple.

Selected information was enlarged, by ginning periods, to ginnings reported by the districts (State subdivisions) used in compiling reports on cotton quality statistics. Totals by districts were combined by ginning periods to provide State estimates.

Total ginnings of upland cotton were above 13,577,000 bales in 1954-55, and information was secured which applied to 11,881,586 bales or approximately 88 percent of the crop. The loss in volume was caused in part by the fact that little or no information was obtained or cotton ginned before September. Also, several minor producing States and areas were excluded since the volume or distribution of Smith-Doxey samples fell short of a sound basis of estimation. During the study, 313,876 bale samples were examined, representing 2.6 percent of total ginnings covered by the report.

After the 1954-55 harvest, visits were made to 57 cotton shippers in the Dallas, Houston, and Memphis markets. Information was obtained from these firms on practices and problems in handling cotton from five major producing districts where the study indicated that mixed-quality bales had occurred in proportions greater than the national average.

Also, for the same five districts, the randomly selected classification data for 1954-55 were sorted by gins. It was found that several gins in each district, from which cotton was selected by chance at intervals during the season, rather consistently had an abnormally high percentage of mixed-quality bales. Arrangements were made to have the entire 1955-56 ginnings of 10 of these gins (2 gins per district) recorded on special class sheets. At the close of the season, visits were made to each gin to determine the manner in which mixed-quality bales arrived at the gin. In this way, information was assembled on how many mixed-quality bales were from one-bale loads of seed cotton and how many were from multiple-bale loads. If from multiple-bale loads, positions of these bales in the loads were recorded.

During the 1957-58 season, both sides of about 11,500 bales were tested by micronaire, Pressley strength tester, and fibrograph instruments. 3/ Variations in test results were tabulated by territory of growth.

RULES AND REGULATIONS RELATING TO MIXED-QUALITY BALES

Regulations of the U. S. Department of Agriculture governing cotton classed by Boards of Cotton Examiners and trading rules of most spot cotton exchanges and trade associations include provisions relating to mixed-quality bales. Nowhere, however, is there included any specific definition of how much admixture need occur within a sample before the bale should be designated as mixed in quality. This situation does not indicate any indifference to the problem. Instead, it merely reflects its complexity.

Definition does exist in the case of severely mixed bales, which are called "mixed packed." Classing regulations of the Department define mixed-packed bales as those where the two sides of the sample differ by three grades or more, by three color gradations or more, by two grades and two colors or more, or by 1/8 inch or more in staple. In Government classing, such bales are not only designated as "mixed-packed," but the class of each side of the sample is listed. Within the trade this definition is widely accepted. Rules of most trade groups include some mention of mixed bales. Most common is the clause that mixed-packed bales may be rejected if the low side of the sample is below Good Ordinary or shorter than 7/8 inch.

3/ This volume of samples originally had been collected throughout the season on a Belt-wide basis and tested for use in releasing periodic reports on fiber and processing results on some varieties of cotton grown by selected cotton improvement groups.

Only a small proportion of mixed-quality bales fall into the mixed-packed group. Trade rules dealing with bales that are not mixed severely enough to classify as mixed packed customarily are not specific. In several instances, rules provide for rejection of "plated" bales without spelling out the term. At one exchange, bales with differences of 1/16 inch or more are called "mixed staple" and are subject to rejection. This same exchange also requires that samples of cotton being offered for sale must be displayed with the low side up. At another exchange, mixed-quality bales may be rejected if the bale, upon resampling, is found to be lower in grade than indicated by the original sample.

In recent years, bale classification memoranda issued by the Department have listed separate classifications for each side of bales which were less than mixed packed but had a difference of two grades, or one color, or 1/16 inch in staple. At the time the study was initiated, this procedure was followed only at offices in the West. Now this practice is Belt-wide. For the purpose of this study, the definition adopted followed the practice stated as the starting point for mixed-quality bales for staple (1/16 inch) and color (one color variation). For grade, however, instead of starting with differences of two grades, any bale with a variation of one full grade was counted as being mixed quality. Although a one-grade difference at Middling and above normally accounts for a small difference in value, a full grade variation at levels below Middling usually involves a range in value of $10 or more per bale.

EXTENT OF MIXED-QUALITY BALES

Geographic Distribution

Samples examined regularly throughout the 1954-55 season on a practically Belt-wide basis indicated that about 3.4 percent of the Upland crop consisted of mixed-quality bales (table 1). In terms of the total Upland production of about 13,577,000 bales, the indication was that about 462,000 bales were of mixed quality.

During the season of study, proportions of mixed-quality bales were above the national average in only three States, Arkansas, Oklahoma, and Texas. Together, Oklahoma and Texas produced about a fourth of the entire crop and accounted for half of the mixed-quality bales. These two States, together with Arkansas, ginned about 37 percent of production and approximately 70 percent of the mixed-quality bales. In other States, the proportion of mixed-quality bales observed ranged from 1 to about 2 percent of ginnings.

The smallest percentage of mixed-quality bales, 1.0 percent, was found in South Carolina, followed closely by Tennessee with 1.2 percent. In the three Western States, where gins normally operate around the clock in peak season, the relative occurrence of mixed-quality bales ranged only from 1.5 percent in New Mexico to 1.7 percent in Arizona. Except for the sizable quantities of mixed-quality bales found in Arkansas, Oklahoma, and Texas, the

Table 1.--Mixed-quality cotton bales: Proportions of cotton classed as bales of mixed quality, by major cotton-growing States and districts, season 1954-55 1/

State	Proportion of ginnings estimated to be mixed-quality bales, by specified districts:							
	1	2	3	4	5	6	7	State
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
Alabama	2.0	1.9	2.7	--	--	--	--	2.1
Georgia	.7	2.0	3.2	--	--	--	--	1.8
North Carolina	2/	2.8	1.6	--	--	--	--	2.2
South Carolina	.9	.9	1.2	--	--	--	--	1.0
Arkansas	5.8	6.1	4.4	4.7	--	--	--	5.5
Louisiana	3.6	.8	1.3	2/	--	--	--	2.0
Mississippi	2.6	1.2	.4	1.7	--	--	--	1.9
Missouri	1.8	--	--	--	--	--	--	1.8
Tennessee	1.2	2/	--	--	--	--	--	1.2
Oklahoma	11.5	9.9	12.6	--	--	--	--	11.4
Texas 3/	6.1	5.8	10.3	8.3	7.9	3.9	10.9	6.3
Arizona	1.7	--	--	--	--	--	--	1.7
California	1.6	--	--	--	--	--	--	1.6
New Mexico	1.5	--	--	--	--	--	--	1.5
United States	--	--	--	--	--	--	--	3.4

1/ Districts used by the U. S. Department of Agriculture in reporting cotton quality statistics.
2/ Excluded from the study.
3/ Districts 8, 9, and 10 excluded.

extent of such bales was less than had been anticipated in light of available comments. Although this study covered only the one crop, information gathered at the close of the season indicated that proportions of mixed-quality bales were not radically different from those in the preceding several crops.

For those States which were subdivided into districts, generally there was some variation in proportions of mixed-quality bales within States. In the Southeast, where mixed-quality bales appeared in small relative volumes in all States, districts composed mainly of counties in the Coastal Plain tended to show greater percentages of mixed-quality bales than those situated in the Piedmont area (fig. 1). Also, there was a tendency in the South Central States for mixed-quality bales to occur in slightly larger proportions

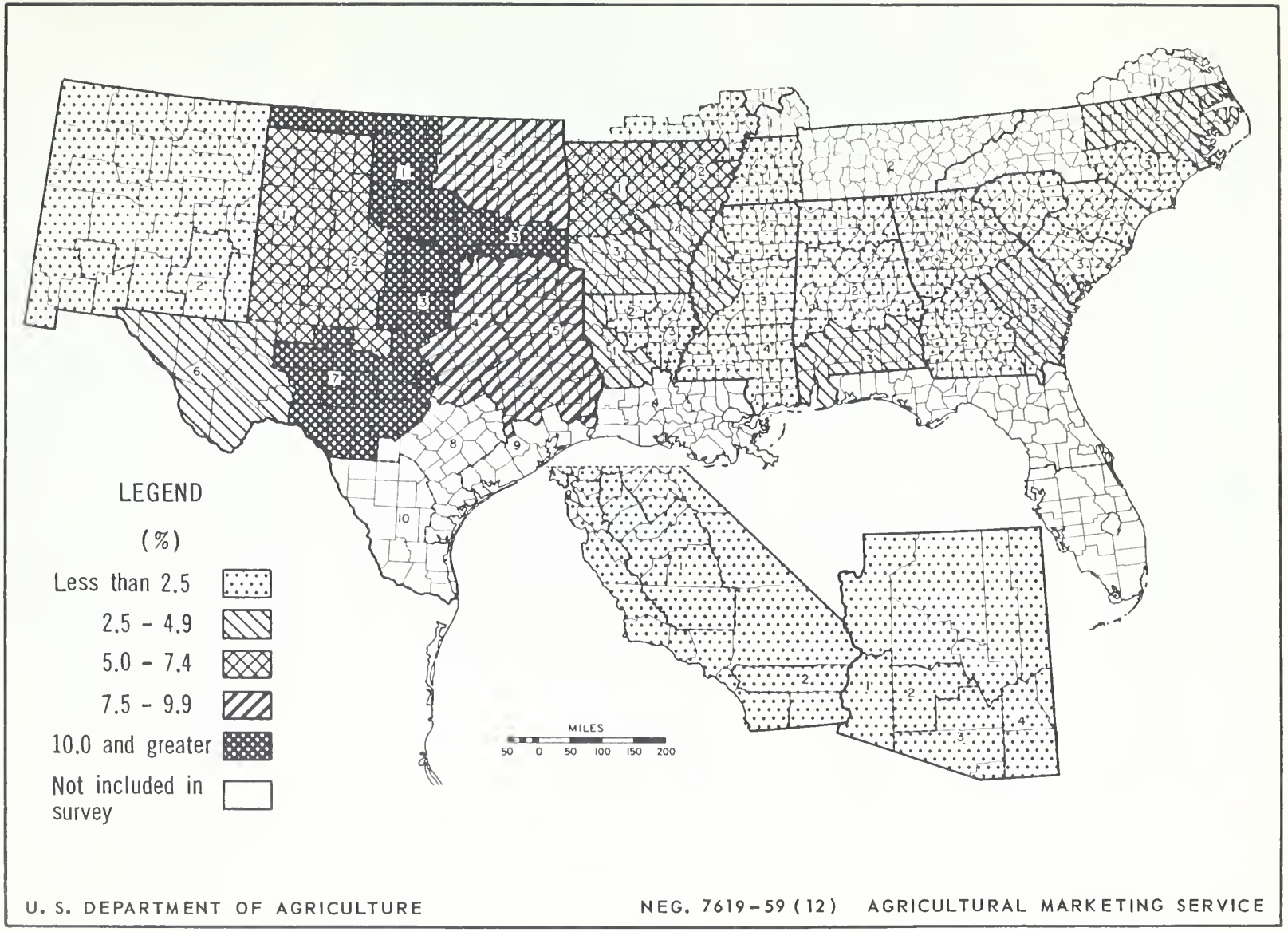


Figure 1.--Percentages of total ginnings of Upland cotton that were of mixed quality, by quality reporting districts, season of 1954-55.

in the alluvial soil districts than in the so-called "hill" sections. Mississippi, District 1 (Yazoo-Mississippi Delta), which produced slightly more than half of the crop for the State, had a percentage of mixed-quality bales about double that for the other 3 districts combined. Arkansas, District 2, the important northeastern area accounting for approximately three-fifths of the State ginnings, had a slightly higher incidence of mixed-quality bales than in the rest of the State.

In the Southwest, all districts in Oklahoma had a high rate of about 10 percent or more of mixed-quality bales. Also in Texas, Districts 3 and 7 had about one-tenth of ginnings in the mixed-quality category, but these two districts together accounted for only 1 percent of the State crop. In District 1 (High Plains), which produced 41 percent of the State total, about 6 percent of ginnings were mixed-quality bales. Also, the important district 4 (Central Texas or Blackland) had approximately 8 percent of bales falling into the mixed-quality grouping. The smallest proportion of mixed-quality bales in Texas was in District 6 (El Paso-Pecos section), with about 4 percent mixed. This district, however, generally is considered a part of the Western region.

Seasonal Distribution

A general assumption about mixed-quality bales in many areas has been that such bales occur with increasing relative frequency as harvesting progresses during a season. For the Cotton Belt as a whole, during 1954-55, proportions of ginnings that were mixed in quality increased from 2.7 percent in September to a high of 5.7 percent for cotton ginned after January 16 (table 2). In many States, a progressive buildup in the rate of mixed-quality bales was found from the beginning to the very end of the season. In Alabama, Georgia, Louisiana, Missouri, Texas, and California, proportions of mixed-quality bales were from about 3 to 10 times greater toward the close of the harvest than early in the season. The pattern in both North Carolina and New Mexico was in contrast, with early relative increases followed by declines in the late season. In South Carolina and Tennessee, the incidence of mixed-quality bales was irregular, while in Arkansas, Mississippi, and Oklahoma, mixed-quality bales occurred at about the same general level through most of the season.

On the whole, factors tending to influence the final stages of the harvest include unfavorable weather conditions, long field exposure of remaining cotton, use of varying methods of harvest, and combination of seed cotton remnants into bales. By and large, such circumstances did create a significant increase in the rate of mixed-quality bales.

Table 2.--Mixed-quality cotton bales: Proportion of ginnings classed as mixed-quality bales by time of ginning, by States, season 1954-55

State	Proportion of ginnings classed as mixed quality during:					
	September	October	November	December 1 to January 16	After January 16	Season 1/
	Percent	Percent	Percent	Percent	Percent	Percent
Alabama	1.8	2.6	4.7	8.6	4/	2.1
Georgia	1.5	2.0	2.2	4.0	4/	1.8
North Carolina 2/	3/	3.4	5.8	4.4	4.6	2.2
South Carolina	1.1	3/	.7	1.0	4/	1.0
Arkansas	5.2	5.7	5.5	8.1	5.0	5.5
Louisiana 2/	1.9	2.3	2.3	4.1	4/	2.0
Mississippi	1.5	2.2	2.3	1.8	4/	1.9
Missouri	1.3	1.6	1.9	6.5	12.6	1.8
Tennessee 2/	1.2	.7	2.4	1.6	4/	1.2
Oklahoma	14.5	8.9	13.4	12.3	4/	11.4
Texas 2/	5.4	6.9	5.1	8.8	14.3	6.3
Arizona	.8	1.1	1.2	2.4	5.7	1.7
California	1.1	1.4	1.2	2.3	3.8	1.6
New Mexico	.5	1.8	1.6	1.2	1.0	1.5
United States	2.7	3.6	3.5	5.1	5.7	3.4

1/ Includes ginnings prior to September where available.
2/ Excludes District 1, North Carolina; District 4, Louisiana; District 2, Tennessee; and Districts 8, 9, and 10, Texas.
3/ Less than 0.5 percent.
4/ Less than 1,000 bales ginned.

NATURE OF MIXED-QUALITY BALES

Types of Mixed-Quality Bales by State Origins

Among mixed-quality bales, the type and degree of quality admixtures varied widely. Actually 50 different types of quality variations were found, but in the great majority of cases, only 1 quality element was involved. Of the total volume of mixed-quality bales in the 1954-55 season, about 64 percent were mixed in grade only (table 3). Another 7.5 percent were mixed in staple only and 5.6 percent in color only. A remainder of approximately 23 percent were mixed in two or more quality elements.

Table 3.--Mixed-quality cotton bales: Proportions of mixed-quality bales by nature and degree of quality admixtures, by States, season 1954-55

State	Proportions of mixed-quality bales which were mixed in --																Total
	Grade only			Staple only			Color only		Grade and staple		Grade and color		Color and staple		Grade, color and staple		
	1 grade	2 grades	Mixed pack	1/16"	3/32"	Mixed pack	Less than mixed pack	Mixed pack	Less than mixed pack	Mixed pack	Less than mixed pack	Mixed pack	Less than mixed pack	Mixed pack	Less than mixed pack	Mixed pack	
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
Alabama	54.5	4.9	--	8.3	2.0	0.7	6.7	--	1.2	--	19.6	2/	1.4	--	0.7	--	100.0
Georgia	46.0	4.1	.2	14.1	9.6	.2	4.9	2/	6.6	--	12.1	.2	.5	--	1.5	--	100.0
North Carolina	86.6	7.3	.2	1.2	--	--	1.1	--	--	--	3.6	--	2/	--	--	--	100.0
South Carolina	75.7	2.4	2.0	2/	--	--	1.1	--	1.8	--	14.7	--	2.3	--	--	--	100.0
Arkansas	65.9	7.7	.6	4.0	.9	.2	2.6	--	2.6	.1	13.3	.3	.3	--	1.0	.5	100.0
Louisiana	56.4	8.8	.9	3.1	.7	.4	5.5	--	2.8	--	15.3	1.1	--	--	4.0	1.0	100.0
Mississippi	75.5	6.6	1.2	4.1	.5	.4	3.2	--	1.4	.1	6.6	.2	--	--	.2	--	100.0
Missouri	66.7	5.1	.9	2/	--	--	8.0	--	--	--	17.4	.6	--	1.3	--	--	100.0
Tennessee	74.7	10.1	--	6.5	--	2.1	.3	--	1.1	--	4.2	--	1.0	--	--	--	100.0
Oklahoma	34.6	3.4	--	18.2	.6	--	6.2	--	7.6	.3	24.1	.9	1.1	.1	2.9	--	100.0
Texas	51.4	2.7	.3	5.5	.9	1.6	7.7	2/	2.8	.2	22.3	.8	1.0	.1	2.4	.3	100.0
Arizona	74.7	14.3	1.6	2/	--	--	3.5	--	1.1	.7	3.7	.2	--	--	--	.2	100.0
California	58.7	19.3	2.1	.2	--	--	4.0	.1	.2	.1	13.0	2.0	.1	--	.1	.1	100.0
New Mexico	16.5	41.5	.3	12.0	2.8	--	6.1	--	5.7	--	13.7	--	--	--	1.2	.2	100.0
United States	56.9	6.2	.6	5.7	1.0	.8	5.6	2/	2.7	.2	17.1	.7	.6	.1	1.6	.2	100.0

1/ Mixed-packed bales are mixed-quality bales with admixtures between the two sides of the samples of: Three or more grades, 1/8 inch or more variation in staple, three color gradations or more, or two grades or more plus two color gradations or more.

2/ Less than 0.05 percent.

As indicated previously, minimum admixtures used in classifying a bale as being of mixed quality were differences between the two sides of the sample of one grade, or 1/16 inch in staple length, or one color. About 70 percent of mixed-quality bales were of such minimum degrees of admixture. At the other end of the scale, 2.6 percent of mixed-quality bales were so severely mixed that they were classed as mixed packed.

In all States except Oklahoma, most mixed-quality bales were the result of admixtures in grade only. In North Carolina, South Carolina, Mississippi, Tennessee, Arizona, and California, more than 80 percent of the mixed-quality bales resulted from grade differences only. In Oklahoma, less than 40 percent of the mixed-quality cotton was due to grade admixtures alone. In all other States, grade admixtures were the cause in about half to three-fourths of the mixed-quality bales.

Belt-wide, about nine-tenths of the bales that were mixed in grade only had a one-grade variation. In most States, the severity of grade admixtures followed this national pattern fairly closely. In all three Western States, however, grade admixtures were more severe than in the rest of the Belt; approximately 18, 27, and 72 percent of such bales in Arizona, California, and New Mexico, respectively, were accounted for by variations of two grades or more.

Variations in staple only caused 7.5 percent of the total mixed-quality bales on a national basis. By States, there were large differences in the relative importance of staple as a factor in creating mixed-quality bales. In South Carolina, Missouri, Arizona, and California, bales of mixed staple were practically nonexistent. In these States, Upland cotton was grown almost exclusively from a single variety, except in Missouri, where the several popular varieties were highly similar in staple normally produced. In Georgia, Oklahoma, and New Mexico, from about 15 to 24 percent of all mixed-quality bales were mixed in staple only. Elsewhere, the relative importance of staple alone in causing mixed-quality bales was about equal to or below the Belt-wide average.

Color alone accounted for 5.6 percent of the mixed-quality bales. In North Carolina, South Carolina, and Tennessee, about 1 percent or less of the mixed-quality bales resulted from color variations alone. Elsewhere, by States, color accounted for about 3 to 8 percent of mixed bales.

Among the approximately 23 percent of mixed-quality bales caused by variations in two or more quality elements, the combination of grade and color accounted for three of every four bales. This type of admixture was particularly common in Alabama, Oklahoma, and Texas.

Quality mixtures involving both grade and staple were relatively few in all States, but occurred in greater proportions in States such as Georgia, Oklahoma, and New Mexico, where variations in staple only, also, were comparatively substantial. The combination of color and staple was a minor cause of mixed-quality bales in all States. The maximum conglomeration of quality

within bales--those admixed in grade, staple, and color--was 1.8 percent of the total volume of mixed bales. Practically all of these triple-admixed bales originated in Louisiana, Oklahoma, and Texas.

Effect of Time of Ginning on Type of Quality Mixture

As was anticipated, color played an increasing role during the progress of the season in causing or contributing to mixtures in bale quality. In September, about 4 percent of the mixed-quality bales were mixed in color only, but after December the proportion was slightly more than 10 percent (table 4). Likewise, proportions of bales that were mixed in both color and grade increased from about 9 percent in September to about 31 percent in the period December 1 to January 16.

An unexpected but equally definite trend was shown by the decided decreases during the season in proportions of bales that were mixed in staple. In September, about 13 percent of mixed-quality bales resulted from variations in staple alone. By the final stage of the season, after January 16, only 1 percent of the mixed-quality bales were accounted for by staple mixtures alone. When considered both separately and in combination with other quality elements, the decrease in staple mixtures as a cause of mixed-quality bales was less spectactular but still sizable.

Grade was amazingly stable as a factor in mixed-quality bales. For the season as a whole, grade variations appeared in about 86 percent of all mixed-quality bales, either alone or along with some other element. By ginning periods, comparable figures ranged from a low of about 83 percent in September to a high of about 89 percent in October.

MONETARY SIGNIFICANCE OF MIXTURES OF QUALITY WITHIN BALES

Comments on the disadvantages of mixed-quality bales often emphasize occasions when such bales create added costs in marketing or difficulties at the mill level. This approach to the problem ignores an economic loss which occurs every time a mixed-quality bale is tied out at a gin. When a cotton grower sells a mixed-quality bale, the higher value of the better cotton is an outright loss since the bale brings only the price set by the poorer cotton. Estimates by persons long experienced in opening and examining mixed-quality bales indicated that admixtures within such bales frequently are disproportionate, there being much more of one quality within a bale than the other. According to chance, however, the likelihood is just as great that a mixed-quality bale is chiefly of the higher quality cotton as that it is chiefly of the lower quality. For a large group of such bales, the mathematical odds are that the total volume of cotton included would be divided about equally between cotton represented by the low and the high sides of the samples. In such cases, the grower is the only consistent loser valuewise, because the original purchaser and all subsequent owners buy the bale on the lower value unless error or fraud is involved.

Since actual classification of thousands of mixed-quality bales was available from the 1954-55 season, the differences in value within these bales were calculated by State and by type and extent of admixture. Average grade and staple differences for the 14 designated spot markets for the 1954-55 season were used for this purpose. 4/

For the Cotton Belt as a whole, there was an average price difference of 210 points per pound between the grade and staple of the high and low sides of mixed-quality bales (table 5). This spread amounted to $10.50 per 500-pound bale. Assuming a 50-50 distribution of the better and poorer cotton, the net loss to growers was $5.25 per bale. The 1954-55 crop included about 462,000 bales that were estimated as being mixed in quality. If these bales had been marketed as bales of uniform quality, income of the cotton growers involved would have been increased by approximately $2,425,500 for this one season.

By States, average differences in value within mixed-quality bales of all types ranged from a high of 305 points per pound in New Mexico, a State with a very small proportion of such bales, down to 153 points per pound in Oklahoma, where mixed bales occurred in greatest relative volume. In Texas, the State with the second highest rate of mixed-quality bales, the average spread in value of cotton within mixed-quality bales was 180 points per pound, next to the low figure by States. The lower value differences within mixed-quality bales in these two Southwestern States resulted from the sizable proportions of such cotton that were accounted for by bales mixed in both grade and color. Upon occasion, the sides of samples with the lower color were higher in grade than the sides with the better color, the two factors somewhat offsetting each other with the result that price differences were small.

Variations of 1/16 inch in staple involved price differences of only 138 points, and variations involving both grade and color of less than mixed-packed severity involved differences of only 130 points. The most extreme admixtures in quality, those in bales that were mixed-packed, averaged 461 points per pound in price spread within bales.

Actually, in many seasons the price significance of quality admixtures that result in mixed-quality bales would have been greater than during the season of the study. Premiums and discounts for grades and staples other than the base quality were narrower in 1954-55 than for many seasons. For example, the 14-market average discount in 1954-55 for Strict Low Middling White 1-inch cotton below the price for Middling White of the same staple was 162 points. 5/ Comparable discounts for the 1956-57 and 1957-58 seasons were 292 and 387 points per pound, respectively. In these more recent seasons, losses to growers in selling mixed-quality bales were appreciably greater than in 1954-55

4/ Average 14-market differences for major white and other selected grades are shown in table 11. Differences used for light spotted, light gray, and below-grade bales were obtained from various trade sources.

5/ Appendix table 11 lists the average 14-market differentials in 1954-55 for selected white grades and trade information for other selected grades.

Table 5.--Mixed-quality cotton bales: Price differences in points per pound between high and low qualities of cotton included in mixed-quality bales, by selected types of admixture and by States, season 1954-55 1/

State	Difference in value per pound of cotton within bales mixed in quality by --						
	One grade	Two grades	1/16 inch staple	Color, less than mixed-packed	Grade and color, less than mixed-packed	All mixed-packed bales	All mixed-quality bales
	Points	Points	Points	Points	Points	Points	Points
Alabama	179	420	119	285	105	2/	184
Georgia	201	306	122	300	153	421	209
North Carolina	221	389	2/	320	138	2/	236
South Carolina	169	322	2/	424	113	2/	189
Arkansas	180	346	126	330	143	446	201
Louisiana	200	366	148	271	111	545	216
Mississippi	191	384	127	337	188	476	218
Missouri	199	419	2/	342	122	354	221
Tennessee	189	365	119	393	368	2/	228
Oklahoma	133	297	128	146	107	466	153
Texas	170	346	144	233	111	370	180
Arizona	200	425	2/	291	277	798	246
California	211	378	184	226	155	520	248
New Mexico	233	391	188	290	179	2/	305
United States	188	377	138	263	130	461	210

1/ Calculated on basis of average 14-market differences for grade and staple for 1954-55 season in terms of points per pound (1 point equals 1/100 cent).
2/ Such admixtures either not observed or else found in insignificant volume.

PRACTICES OF SHIPPERS IN MERCHANDISING MIXED-QUALITY BALES

Collection of information from cotton shippers on problems encountered and practices followed in handling mixed-quality bales was limited to cotton grown in Oklahoma, District 1; Texas, Districts 1 and 4; and Arkansas, Districts 2 and 4. These five districts ginned approximately one-fourth of the total 1954-55 production and accounted for about half of all mixed-quality bales. Visits to selected shippers in only three central markets--Dallas, Houston, and Memphis--provided representative data on cotton originating from these districts. Since Districts 2 and 4 in eastern Arkansas form a continuous area, these two districts were considered as one territory in discussions with shippers.

A total of 57 shippers were visited, including 27 firms at Memphis, 22 at Dallas, and 8 at Houston. These firms purchased about half of the cotton ginned in the five districts in 1954-55 (table 6). Quantities purchased, by districts, ranged from more than three-fourths of the crop in District 4, Texas, to only slightly above one-third in District 1, Oklahoma. Actually, a sizable part of ginnings in several districts entered and remained in the loan, particularly in Districts 1, Oklahoma and Texas, thereby reducing proportions of the total crop in those districts which were available for purchase by shippers.

For the five districts combined, shippers estimated that 6.4 percent of purchases consisted of mixed-quality bales, compared with 6.3 percent indicated by the survey of total ginnings. By districts, estimates by shippers on the relative volume of mixed-quality bales acquired were reasonably close to overall results of the study except for District 1, Oklahoma. There the proportion of mixed-quality cotton found in the season-long survey of the entire crop was almost three times greater than estimated by these shippers, who handled slightly more than one-third of the total production.

Shippers were asked if the five specified districts were the major sources of mixed-quality bales bought during the season. The majority of firms replied in the affirmative. Other major trouble spots named were Louisiana District 4 (south central), and Texas Districts 8, 9, and 10 (lower Rio Grande Valley and coastal bend). These four districts were excluded from the study, as previously explained, but limited information received did indicate existence of such bales in greater proportions than the national average. Also, several firms remarked on the relatively high proportions of mixed-quality bales among late-season cotton in Missouri and to a less extent in Mississippi, District 1; these situations were indicated also by the study results.

Most firms did not consider mixed-quality bales a serious problem in buying cotton. Some firms reported that they did not buy mixed-packed bales or less mixed bales with marked color variations. A few firms, especially in Memphis, stated that no mixed-quality bales were purchased intentionally. A total of 14 firms reported that only 1 percent or less of purchases from the specified areas consisted of mixed-quality bales. Several shippers made a practice of discounting in price all lots with unusually large numbers of mixed-quality bales, since new samples for such lots might show inconsistencies in the class of the mixed-quality bales as well as admixtures in additional bales. In general, shippers appeared to accept these bales as an unavoidable annoyance and minor risk inherent in the business. They did make claims upon sellers at times, however, when resamples indicated significant error in the original samples.

After mixed-quality bales had reached a compress, it was feasible in some cases to recondition the bales. This involved examination of individual bales, which often required removal of the ties to establish the nature and extent of the admixtures and the practicability of removing the lower quality of cotton. Of the 57 firms, 18 reconditioned no bales of mixed-quality cotton during the season of the study, chiefly because of the limited purchases made of such bales.

Table 6.--Mixed-quality cotton bales: Total Upland cotton production and proportions of mixed-quality bales, and purchases by selected shippers and estimated proportions of mixed-quality bales, by specified cotton quality reporting districts, season 1954-55

Item	Unit	Quality reporting districts				
		Arkansas: 2 and 4	Texas: 1	Texas: 4	Oklahoma: 1	All districts
Ginnings, season 1954-55	1,000 bales	1,221	1,580	440	213	3,454
Proportions of ginnings estimated as mixed quality	Pct.	5.6	6.1	8.3	11.5	6.3
Purchases by 57 selected shippers	1,000 bales	522	750	335	75	1,682
Proportion of shippers' purchases estimated as mixed in quality	Pct.	4.5	7.5	7.3	4.3	6.4

These 18 firms purchased about one-fifth of the total cotton bales obtained from the 5 districts by this group of shippers, but reported acquiring slightly less than one-tenth of the mixed-quality bales. The 39 firms which did recondition some mixed-quality bales were asked what guide was used in determining which bales should be examined for possible reconditioning. Eight firms replied that they had no general rule. Among the 31 firms which followed a usual practice, 17 said that bales with a variation of 200 points or more per pound between the two sides of samples normally were examined for possible reworking of the bale. Another nine firms usually checked bales with mixtures of two grades or more, or 3/32 inch or more in staple, or two colors. The other firms generally attempted to recondition only very extreme admixtures such as mixed-packed bales.

The 39 firms together acquired 1,360,894 bales from the 5 districts, of which 97,189 bales were estimated to be of mixed quality (table 7). Approximately 13,000, or about 13 percent, of these mixed-quality bales were examined for possible correction of the quality irregularity. Of the total number of bales examined, 5,318, or about 41 percent, were reconditioned. The bales actually reconditioned amounted to only 5 percent of the total purchases of mixed-quality bales from the 5 districts by all 57 firms.

Average costs, according to estimates by shippers, were $5.22 per bale for reconditioning and $2.47 per bale for those examined but found unsuitable for reconditioning. When, however, the costs of reworking the 5,318 bales and of examining but not reworking the 7,746 bales were totaled and applied to those bales actually reconditioned, the sum was $8.82 per bale, or about 176 points per pound. With an average increase in value of 176 points per bale required to break even on the operation, it was obvious that most mixed-quality

Table 7.--Mixed-quality cotton bales: Volume of purchases from specified cotton quality reporting districts, volume of bales examined and reconditioned, and costs per bale, by 39 selected cotton shippers, season 1954-55 1/

Item	Unit	Total purchases from Arkansas districts 2 and 4, Oklahoma district 1, and Texas districts 1 and 4
Total volume of cotton purchases	Bales	1,360,894
Volume of mixed-quality bales purchased	"	97,189
Volume of mixed-quality bales examined for reconditioning	"	13,064
Volume of mixed-quality bales reconditioned	"	5,318
Cost per bale for cotton examined but not reconditioned	Dollars	2.47
Cost per bale for cotton reconditioned	"	5.22

1/ Includes only shippers who reconditioned some of the mixed-quality bales purchased from the specified districts.

bales could not be corrected in marketing channels as normal procedure. Also, bales mixed in staple frequently did not lend themselves to reconditioning, as was also the case for many bales badly mixed in grade or color.

The overall situation tended to disprove the occasional belief that shippers reaped tidy profits by a large-scale practice of stripping off thin plates of low-grade cotton from otherwise high-grade bales. Apparently the chief reason for reworking bales was to increase the quality uniformity of bales going to mill customers.

Shippers stated that claims based on mixed-quality bales seldom were received from mills. In 1954-55, however, shippers did mention an unusually large number of mill claims concerning false-packed bales, which are those with equal quality in the two sides of the sample but with inferior cotton in the interior of the bales.

PROBABLE CAUSES OF MIXED-QUALITY BALES

It is a common belief that mixed-quality bales are made usually by ginners turning the press before all cotton from a bale has reached the press box. When this is done, the following bale starts with some cotton belonging to the bale just completed. If this practice is followed rather consistently, most bales will include small amounts of cotton on one surface that originated from preceding bales. In the days when practically all cotton arrived at gins in

one-bale loads, this practice would cause many bales to include some cotton from a different farm, possibly of a different variety, or harvested at a different time or by a different method. Now much cotton in many areas is brought to gins in trailers holding from two to six bales or more, thereby reducing the probability of mixing cotton from different growers. This situation raises the question of what proportion of mixed-quality bales results from growers bringing mixed loads of seed cotton to gins.

Another ginning practice, the running of overflow cotton back through the system in the final stage of completing a bale, has been mentioned as a probable cause. It seems doubtful, however, that this practice would result in enough quality changes to create mixed-quality bales to a significant extent.

Data obtained in 1954-55 by districts indicated no apparent relationship between proportions of mixed-quality bales and typical ginning organization. Relatively few mixed-quality bales were found either in western States where gins handled large volumes of cotton generally received as multiple-bale loads or in southeastern districts where much cotton arrived as one-bale loads at small-volume gins. In Texas and Oklahoma, percentages of mixed-quality bales were consistently high, but ginning conditions varied widely among some districts.

In an attempt to throw some light on causes of mixed-quality bales, information was obtained in 1955-56 from 10 gins which had records of turning out abnormally large proportions of such bales during the 1954-55 season. Gins were selected to include two from each of five districts (Arkansas, Districts 2 and 4; Texas, 1 and 4; and Oklahoma, 1). Boards of Cotton Examiners concerned (Altus, Oklahoma City, Lubbock, Dallas, Little Rock, and Blytheville) received samples covering more than 99 percent of the total volume of the selected gins. These offices made duplicate class sheets for each lot from selected gins and recorded the class for both sides of mixed-quality bales, using the same definition for such bales as was followed during the Beltwide survey in 1954-55. After the close of the season, field representatives visited each gin and marked all bales received in multiple-bale loads (two or more bales per load). For eight gins, all multiple loads were identified, but at two gins only multiple loads which included mixed-quality bales were indicated.

The 10 gins had a combined volume of 34,125 bales, of which 5.6 percent were of mixed quality. By districts, proportions of mixed-quality bales ranged from 3.8 percent at the two gins in District 1, Texas, up to 17.8 percent at the gins in District 4, Texas.

Of the eight gins for which information was available on the amounts of cotton received by size of load, 60 percent of the cotton arrived as one-bale loads and 40 percent as loads of two or more bales each. At these gins, 69 percent of the mixed-quality bales originated from single-bale loads and 31 percent from multiple-bale loads, indicating that one-bale loads produced more than their proportionate share of mixed-quality cotton.

Although data were not available on the total volumes of cotton received by size of load for the 10 gins as a group, information was obtained on the major points of interest. For all 10 gins, 55 percent of the mixed-quality bales originated from one-bale loads and 45 percent from loads of two or more bales (table 8). Of major importance was the fact that two-thirds of the mixed-quality bales ginned from multiple-bale loads were first bales in loads which produced only one mixed-quality bale. The other one-third of mixed-quality bales occurring from multiple loads were in the interior of the load or were from loads which included two or more mixed-quality bales. This latter group of mixed-quality bales appear to be removed from responsibility on the part of the ginners and were assumed to have arrived at the gins as seed cotton of mixed quality. On the other hand, 85 percent of the mixed-quality bales were immediately preceded by bales from other growers, and such bales could have been mixed in quality by practices followed in gin operation.

Table 8.--Mixed-quality cotton bales: Proportions of mixed-quality cotton bales according to manner and order of arrival of seed cotton at gins, 10 selected gins, 1955-56 season

Manner and order of arrival at gins	Proportion of mixed-quality bales
	Percent
As single-bale loads	55.0
As multiple-bale loads:	
First and only mixed bale	30.1
Second or later bale 1/	14.9
All loads	100.0

1/ Includes loads which contained two or more mixed-quality bales.

The classifications of both sides of mixed-quality bales which had been susceptible to mixing at gins by introduction of cotton from other farms were compared, bale by bale, with the classifications of the preceding bales. The reasoning behind this comparison was that if a bale is plated by receiving cotton from the preceding bale, the classification of one side of the sample of the mixed bale should be the same as for the bale which it followed. On this basis, about half of such mixed-quality bales did match preceding bales in grade and staple (table 9). As would be expected, in the cases where one side of the mixed-quality bale and the preceding bale were alike in quality, this similarity was about equally divided between a match with the low-quality sides and the high-quality sides of the mixed bales. If a bale does become mixed by receiving unlike cotton from the bale just ahead, there should be about equal opportunity for this plate to be higher in quality as to be lower.

Table 9.--Mixed-quality cotton bales: Relation of grades and staples of mixed-quality bales to those of preceding bales, 10 selected gins, season 1955-56 1/

Relation of quality of preceding bales to mixed bales	Proportion of bales received as --		
	Single bales	In multiple loads	All loads
	Percent	Percent	Percent
Identical to:			
Low side of sample	19.8	24.9	21.7
High side of sample	27.0	27.6	27.2
No similarity	53.2	47.5	51.1
All bales	100.0	100.0	100.0

1/ Includes only bales in first position in multiple loads and from single-bale loads.

Of probably greatest interest was the fact that slightly more than half of the mixed-quality bales that were in a position to be mixed by receiving some cotton from preceding bales did not have classifications on either side of the samples that indicated such a cause of admixture. Thus there was strong evidence that most mixed-quality bales originated because growers brought mixed loads of seed cotton to gins. For all mixed-quality bales from the 10 gins, the causes apparently were as follows:

Brought to gin as mixed seed cotton	61 percent
Mixed at gin by addition of:	
Higher quality cotton	22 percent
Lower quality cotton	17 percent

The indication that most mixed-quality bales originate away from the gins complicates corrective action. Formation of mixed bales during ginning can be avoided simply by a slight delay in turning the press box when completing a bale which will be followed by cotton from another grower. Mixed loads of seed cotton, originating at farms, however, can be caused by a wide variety of factors, some of which are beyond the control of growers. Not uncommonly, cotton from different parts of the same field may vary naturally in quality. At times, a partly harvested bale must be completed at some later date if harvest is interrupted by unfavorable weather. On the other hand, growers usually can and should avoid loading cotton together that differs in variety or method or time of harvesting. Under test, cotton harvested in early morning has been as much as one full grade lower than cotton picked on the same afternoon from the same field. 6/ Another practice to be avoided is the excessive packing and tramping of part of the load into a trailer, especially when very trashy seed cotton is involved.

6/ Montgomery, R. A., and Wooten, O. B., Agr. Res. Serv. report 42-14, U. S. Dept. Agr., April 1958.

Since there is no clearcut single cause for mixed-quality bales, there is no simple remedy. Instead, reduction of the number of such bales to an irreducible minimum will require coordinated educational programs directed at both growers and ginners.

VARIATIONS IN FIBER CHARACTERISTICS AMONG THE TWO SIDES OF COTTON BALE SAMPLES

In recent years, instruments and tests have been developed for measuring some of the fiber characteristics of cotton such as fineness, strength, length, length uniformity, and maturity. Extensive use of such test results now is made in the marketing of cotton, especially of tests for fiber fineness and to a less extent for tensile strength. Almost exclusively, fiber tests made by marketing agencies on individual bales are based on cotton taken from the same cut samples used in classing these bales in terms of grade and staple. Generally, in trade practice, cotton from only one side of a sample is tested for fineness unless the sample indicates a mixed-quality bale, in which case both sides often are tested.

If a bale of cotton is mixed appreciably in grade or staple, there is definite warning that the two sides of the sample also may differ in fiber characteristics. A matter of concern, however, has been the extent to which fiber test data may vary for the two sides of bale samples which do not differ in grade or staple. This question is important in marketing circles because most Upland bales sold by shippers to domestic mills are delivered according to specifications for fineness and about one-tenth on the basis of strength specifications. 7/ Particularly in the case of fineness tests, any need for testing both sides of samples on a large scale would complicate quality evaluation during marketing.

Because of interest in the variability in test results among cotton bales of uniform grade and staple classification, arrangements were made to test each side of a large group of bale samples collected during the 1957-58 season. These samples had been selected periodically during the season to provide Belt-wide results of fiber and processing tests of cotton grown from leading varieties. 8/ These samples originated from bales produced from pedigreed or certified seed of specified varieties. The careful screening used in the collection of the samples resulted in the proportion of bales mixed in grade or staple being less than 1 percent. Samples representing this small number of mixed-quality bales were excluded from the study. Both sides of the remaining 11,176 samples were tested for fineness, tensile strength, and length, by the micronaire, Pressley, and fibrograph instruments, respectively. These tests

---

7/ Use of Cotton Fiber Tests by United States Cotton Shippers, Southern Cooperative Series Bulletin 62, Arkansas Agr. Exp. Sta., June 1959.

8/ Information on fiber characteristics and spinning performance of specified varieties of cotton produced by growers organized for cotton quality improvement is released at 2-week intervals throughout each harvesting season and in summary form at the close, by the U. S. Dept. of Agr., Agr. Mktg. Serv., Cotton Division.

were made according to procedures widely followed in commercial practice. In micronaire tests, one reading was taken for each side of a sample. Pressley strength test results were based on two breaks for each side of samples, and upper half means were derived from two fibrograph readings per sample side.

Results of these tests were tabulated to record the extent of significant variations between the two sides of each sample in fineness, strength, and U.H.M. (upper half mean). For the purposes of this study, the following measures of significant variation, based on the experience of Department cotton technologists in making such tests, were used.

Fineness..... 0.3 reading
Strength (zero gauge)..... 5,000 pounds p.s.i.
U.H.M..... .05 inch

For the Belt as a whole, two-thirds of the samples tested showed no significant variation between the two sides of the samples in any of the three fiber properties (table 10). About 70 percent of samples originating from all regions except the Southwest were free from significant variation in these fiber properties. Of the Southwestern cotton, approximately 39 percent of samples varied significantly in one or more test properties.

Variations in strength alone accounted for more than half of the bales that showed a significant lack of uniformity between the two sides of samples. From 12.0 percent of the samples in the South Central area up to 18.9 percent of samples from the Western region varied by 5,000 pounds per square inch or more.

Approximately 6 percent of the samples varied significantly in fineness readings only, and another 6 percent showed significant variations in upper half mean alone. By regions, Southwestern cotton had a variability in fineness that was two to five times greater than in other regions. Variations in upper half mean did not differ greatly by regions, but were smallest among Western cottons.

Slightly more than 6 percent of the samples showed significant side-to-side variability in two or more fiber characteristics. Again such multiple variations were more prevalent in Southwestern cotton than in cotton grown elsewhere.

Since large-scale testing of individual bales in marketing channels is confined chiefly to tests for fineness, cotton shippers particularly are concerned with the possibility of error associated with using fineness readings taken from only one side of bales which are uniform in grade and staple. According to the study data, 1 out of 10 such bales had significant variations in fineness readings for the Cotton Belt as a whole. In the South Central region, only 1 out of every 25 bales had a significant lack of uniformity in fineness results. For Southwestern cotton, however, indications were that one of each seven bales differed significantly between the two sides of samples in

Table 10.--Variation in fiber properties between two sides of cotton bale samples: Proportionate distribution of samples by significance of variations in specified fiber characteristics, by region of growth, season 1957-58 1/

Type and extent of variations in fiber test results	Proportion of samples originating from--				United States
	Southeast	South Central	Southwest	West	
	Percent	Percent	Percent	Percent	Percent
No significant variation	70.6	71.6	61.1	69.4	66.7
Significant variations in:					
Fineness only 2/	2.0	5.3	10.2	2.8	5.8
U.H.M. only 3/	7.3	6.7	6.6	4.6	5.8
Tensile strength only 4/	15.7	12.0	12.5	18.9	15.4
Fineness and tensile strength	.9	1.1	4.1	1.5	2.4
Fineness and U.H.M.	.7	1.2	2.7	.7	1.5
Tensile strength and U.H.M.	2.6	1.8	1.7	1.8	1.8
All three properties	.1	.3	1.1	.3	.6
Total	100.0	100.0	100.0	100.0	100.0

1/ Based on samples uniform in grade and staple classification.
2/ Variations of 0.3 or greater in micronaire reading.
3/ Variations of .05 inch or more in upper half mean (fibrograph).
4/ Variations of 5,000 p.s.i. or more (Pressley zero gauge).

fineness readings. The probability of controversy between mills and shippers over Southwestern cotton delivered against fineness specifications appeared considerably greater than for that originating in other regions.

Actually, variability in fiber characteristics in the same bale of cotton is much greater than is generally supposed and than is indicated by readings from the sides of bales. Experimentally, bales which were highly uniform in grade, staple, and fiber characteristics for both sampling surfaces have been broken open and tested at numerous positions throughout the bales. 9/ According to previous definition, significant differences in one or more fiber characteristics were present within most bales.

Variations in the fiber properties of cotton result from a variety of factors, some of which are beyond human control. Fibers develop at different times under different environmental conditions from field to field, among plants in the same field, and among bolls on the same stalk. Even on a seed, fibers vary according to position. Besides these natural limitations, fiber variability within bales may be increased by the same human actions that often contribute to mixtures in grade or staple.

9/ Cotton Testing Service, AMS No. 16, U. S. Dept. Agr., Agr. Mktg. Serv., pp. 48 and 49 (processed), February 1955.

Table 11.--Cotton quality price differences: Average price differences per pound for selected grades and staples, compared to Middling White 15/16 inch, season 1954-55

Grade	Staple (inches)						
	7/8	29/32	15/16	31/32	1	1-1/32	1-1/16
	Points	Points	Points	Points	Points	Points	Points
White: 1/							
Strict Middling	-164	-85	+31	+82	+157	+225	+278
Middling	-189	-109	Base 2/	+47	+114	+180	+229
Strict Low Middling	-331	-250	-149	-99	-48	+5	+42
Low Middling	-529	-458	-391	-344	-296	-253	-228
Strict Good Ordinary	-706	-641	-565	-521	-481	-457	-445
Good Ordinary	-877	-819	-746	-703	-653	-635	-628
Light Spotted: 3/							
Strict Middling	-197	-118	-8	+39	+106	+172	+221
Middling	-362	-281	-180	-140	-79	-26	+11
Strict Low Middling	-520	-449	-382	-335	-287	-244	-219
Below Grade 3/	-1,402	-1,346	-1,272	-1,230	-1,197	-1,172	-1,162

1/ Seasonal average for 14 designated spot markets.
2/ Average price for season was 33.88 cents per pound.
3/ Estimates from trade sources.

U. S. Department of Agriculture
Washington 25, D. C .

POSTAGE AND FEES PAID
U. S. DEPARTMENT OF AGRICULTURE

OFFICIAL BUSINESS